Prediction Rules for the Detection of Coronary Artery Plaques : Evidence from Cardiac CT

JournalArticle (Originalarbeit in einer wissenschaftlichen Zeitschrift)

ID 1194165
Author(s) Saur, Stefan C; Cattin, Philippe C; Desbiolles, Lotus; Fuchs, Thomas J; Székely, Gábor; Alkadhi, Hatem
Author(s) at UniBasel Cattin, Philippe Claude ;
Year 2009
Title Prediction Rules for the Detection of Coronary Artery Plaques : Evidence from Cardiac CT
Journal Investigative radiology
Volume 44
Number 8
Pages / **Article-Number** 483-90
Keywords coronary artery, plaque, computed tomography, spatial distribution, prediction rules
Objectives: To evaluate spatial plaque distribution patterns in coronary arteries based on computed tomography coronary angiography (CTCA) data sets and to express the learned patterns in prediction rules. An application is proposed to use these prediction rules for the detection of initially missed plaques. Material and Methods: 252 consecutive patients with chronic coronary artery disease underwent contrast-enhanced dual-source CTCA for clinical indications. Coronary artery plaques were manually labeled on a 16-segment coronary model and their position (i.e., segments and bifurcations) and composition (i.e., calcified, mixed, or noncalcified) were noted. The frequent itemset mining algorithm was used to statistically search for plaque distribution patterns. The patterns were expressed as prediction rules: given plaques at certain locations as conditions, a prediction rule gave evidence - with a certain confidence value - for a plaque at another location within the coronary artery tree. Prediction rules with the highest confidence values were evaluated and described. Furthermore, to improve manual plaque detection, all prediction rules were applied on the patient data to search for segments with potentially missed plaques. These segments were then reviewed in a guided review for the existence of plaques. The same number of segments was also determined by a weighted random approach to evaluate the quality of prediction selected by frequent itemset mining. Results: In 200/252 (79. plaque (range 1-22 plaques) was found. In total 1229 plaques (990 calcified, 80. over 916 coronary segments and 507 vessels were manually labeled. Four plaque distribution patterns were identified: 20. had no plaques at all; 31. tree; 46. whereas 1. artery (RCA). General rules were found predicting plaques in the left anterior descending artery (LAD) given plaques in segments of the RCA or in the left main artery. Further general rules predicted plaques in the LAD given plaques in the circumflex artery. In the guided review, the segment selection based on the prediction rules from frequent itemset mining performed significantly better ($p<0.001$) than the weighted random approach by revealing 48 initially missed plaques. Conclusion: This study demonstrates spatial plaque distribution patterns in coronary arteries as determined with cardiac CT. Use of the frequent itemset mining algorithm yielded rules that predicted plaques at certain sites given plaques at other sites of the coronary artery tree. Use of these prediction rules improved the manual labeling of coronary plaques as initially missed plaques could be predicted with the guided review.
Publisher Lippincott Williams & Wilkins
ISSN/ISBN 0020-9996

Full Text on edoc No;
Digital Object Identifier DOI 10.1097/RLI.0b013e3181a8afc4
PubMed ID http://www.ncbi.nlm.nih.gov/pubmed/19623688
ISI-Number WOS:000268541200008
Document type (ISI) Journal Article